Module 15
Setup

Learning Objectives

By the end of this section, you will be able to:

1. Know the key setup concerns.
2. Identify equipment conditions that require extra attention.
3. Understand the procedures for properly setting outriggers and blocking.
4. Know the importance of leveling and how it's done.
5. Know common visual indicators for safe setup.
6. Know the basic safety considerations on a site.
7. Know proper crawler, truck and hydraulic crane setup.

To achieve high levels of performance and safety, setup properly for each job.

Proper crane setup is the foundation for safe operating procedures. Ultimately, all operations involving a crane can be serious to the personnel if not performed correctly.

Crane owners, including management and supervisors, are responsible for ensuring that all personnel are sufficiently trained, experienced and competent to safely perform all aspects of crane setup.

Local and federal regulations also dictate responsibility for setup. Although the site supervisor is typically responsible for safe and accurate setup, all parties involved with the operations of the crane and subsequent lifts should ensure a proper and safe crane setup.

OSHA 1926.1404(a)

The setup requirements will vary depending upon:

- Type of crane
- Location of job
- Lifts to be made

The requirements will vary depending upon equipment being used, job being performed, and jurisdictional regulations. The crew must also familiarize themselves with the manufacturer's specifications for crane assembly and erection and follow them precisely unless directed otherwise by the manufacturer's representative.

What are some key setup concerns?

- » Proper crane selection.
- » Safe crane transit.
- » Crane inspection.
- » Site selection.
- » Barricading of work zones.
- » Leveling.
- » Soil compaction.
- » Blocking or mats.

Many mobile crane accidents result from improper setup.

Crane Selection and Transport

What factors need to be considered before selecting a crane for a job?

- » Dimension, weight and radius of heaviest and largest load.
- » Maximum lift height.
- » Number and type of lifts to make.
- » Type of carrier required.
- » Loads-walked or carried.
- » Road bans or limitations.
- » Disassembly required for travel.

Each project must be planned with the maximum load and the full range of equipment in mind.

The supervisor should prepare information for the size of the crane needed and crew required for setup.

There is no room for guesswork in determining the requirements for a job involving expensive and complicated crane equipment.

During assembly, the A/D director must ensure that each component has arrived at the site undamaged.

Crane Inspection

Inspect the crane according to applicable OSHA regulations, ASME standards and manufacturer specifications.

What are some equipment scenarios that require extra care and attention?

- » New equipment.
- » Rented equipment.
- » Repaired or overhauled equipment.
- » Reassembled equipment.
- » Equipment out of use for 6 months or more.
- » Equipment involved in an accident.

OSHA 1926.1412

Blocking & Matting

Adequate blocking and matting material must be readily available and used whenever possible.

Blocking must be rigid and tightly spaced. Stacked blocking must be stable.

Rigid

Tightly spaced

Stable if stacked

Improper use of blocking can have a serious effect on the crane and can result in potentially dangerous conditions.

Span or corner blocking can cause outrigger float failure. Cross blocking layers should be 90 degrees to each other. Never block under outrigger beams. Crane manufacturers design pads that can support outriggers on ideal foundations such as concrete.

OSHA 1926.1404(h)(2) 1926.1404(h)(3)

Outrigger pads/floats, must be placed on firm, graded and drained ground.

OSHA 1926.1404(q)(5)(ii)

The operator must setup for the maximum possible ground bearing pressure.

Cranes operating in different quadrants place varying pressures on the bearing surface on which it sits. Ground pressure is greatly increased during rapid swinging of the machine or sudden stopping of the load. All dynamic or impact loading must be taken into account.

Lifting over a corner creates the highest ground pressure on the bearing surface.

Truck cranes typically impose greater ground pressure than track machines due to smaller total bearing surface area.

On most job sites, blocking or mats are needed to distribute ground pressure over a larger area.

Mats, steel plates, timber pads, etc., distribute the crane's weight across a larger surface area and prevent the crane from sinking or becoming unlevel. If there is any doubt about the stability of the ground on the job site, a soil professional should be consulted. When in doubt, mats should be used.

Timber mats may also be used to supplement ground stability when using crawler cranes.

Typically, 20-30 foot mats are used and are bolted together to create a unit.

Bolting mats together ensures adequate weight distribution thus reducing a crawler crane's tendency to rock when operating on soft ground or when raising or lowering long booms.

Mats are constructed of eight inch or twelve inch timbers. Mats are bolted together at uniform intervals to create any desired width and length.

Typically, mats are 5' wide by 16', 24', or 32' in length. The timber blocking at the side and ends of the tracks must be secured to the mats.

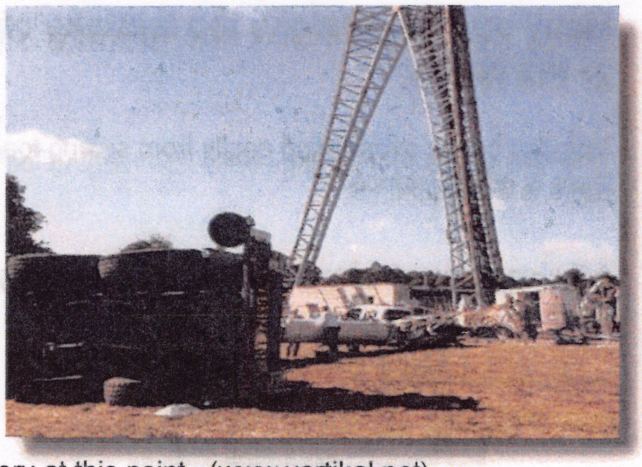
Solid timber such as Douglas Fir is typically used.

SETTING OUTRIGGERS

Crane stabilization is increased through the proper use of:

- Outriggers-Must be fully extended to proper position marks. Must also be adequately supported.
- Crawler extensions-Increased stability by increasing load distribution area
- Stabilizers-Should always be extended and well seated.

Case Study



A four axle All Terrain crane overturned sideways in North Port, between Sarasota and Fort Myers, Florida November 16, 2016. The crane, which looks like a 100 ton Terex AC100-4. The crane had its outriggers short rigged, with the boom fully retracted and the three part 27 metre swing away extension in place. It was working on a very large mobile phone tower. As the crane went over, the boom extension landed across the back of a pick up truck and sliced through the back of a van, but no one was hurt in the incident. The outriggers were not fully extended when there appears to have been plenty of room on site is a mystery at this point. (www.vertikal.net)

Crane should always be set up on crawlers or outriggers (unless lifting on rubber.)

The stability of outriggers is far superior to the stability of tires. The use of outriggers is recommended for every lift!

Outriggers must be properly extended and not interfere with on-site movement.

The area in which the crane is setup must allow for the outriggers to be used as directed by the manufacturer. Extended outriggers should not interfere with on-site movement.

If beams can not be fully extended, always refer to manufacturer's recommended setup procedures.

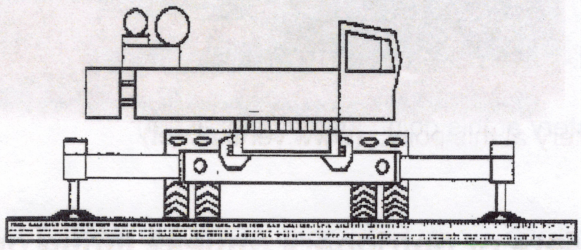
OSHA 1926.1404(q)

When using outriggers, all beams must be properly extended. Always check load chart.

Many operators make the mistake of only extending outriggers on one side of the crane.

This can cause overturning easily from setting load down quickly, sling breaking or gust of wind since there is no resistance.

All tires must clear ground or be free of crane weight.

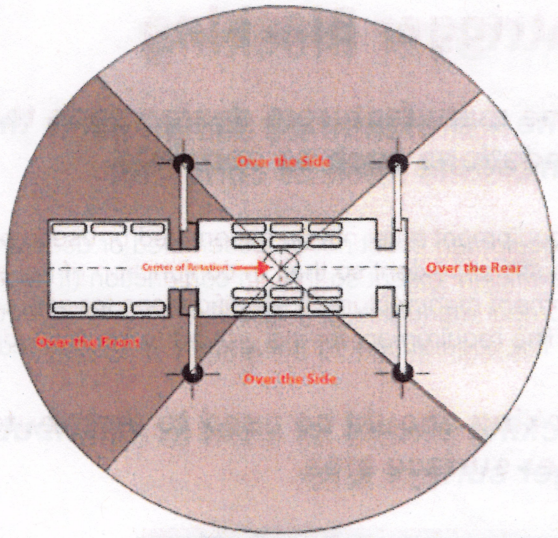


WRONG

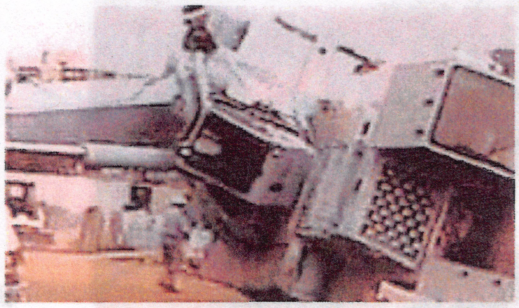
Tires are not off the ground and the outriggers are not fully supporting the crane.

Under no circumstances should crane tires be raised higher than necessary to level crane.

Pressures on each outrigger pad is increased or decreased as boom is rotated, extended or retracted, or loaded.



Case Study



On October 8, 1997, a 56-year-old truck driver (the victim) was crushed when a crane tipped over and the crane's boom landed on the cab of the truck in which he was sitting. The victim, who was hauling excavation material from a 16-story office building construction site, was sitting in the cab of the parked truck waiting to access the excavation site for loading. The mobile all-terrain crane had been set up in preparation for off-loading the components of a tower crane which was scheduled to arrive on site at a later time. The crane operator began to move materials and equipment to make room for off-loading the tower crane components. The crane operator had set up the crane with the left side outriggers fully extended and down, and the right side outriggers down only. This set-up was intended to be temporary until building materials and equipment could be moved to make more room for the all-terrain crane. The crane operator lifted an empty concrete bucket over the rear of the crane and swung the load around toward the front, over the right side. When the lift had progressed to the right front quarter of the adjacent truck, the crane operator began to lower the concrete bucket. When he did so, the crane began to tip. The operator attempted to lower the load to the ground to maintain stability but was unable to respond quickly enough. The crane tipped over and the boom struck the truck's cab directly over the driver's position. The victim was trapped and crushed in the cab. Workers on site notified 911 and rescue personnel responded immediately; however, rescue and first aid attempts were not possible due to the damage to the truck's cab and the crane's boom lying on top of the victim. The victim was recovered about 4 hours after the incident when other cranes were used to lift the boom from the truck cab. The victim was pronounced dead at the scene.

NIOSH investigators concluded that, to prevent similar incidents, employers should:

- Ensure that cranes are operated within their limits of stability as determined by the manufacturer-supplied capacity charts
- Ensure that crane set-ups are optimized with out-riggers fully extended when possible to provide the maximum lifting capacity.

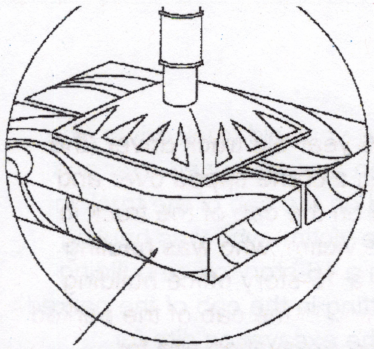
http://www.cdc.gov/niosh/face/In-house/full9802.html

Outrigger Blocking

Crane manufacturers design pads that can support outriggers on ideal foundations such as concrete.

The equipment must not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.

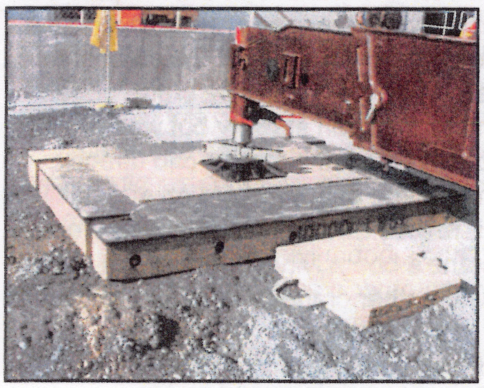
Blocking should be used to distribute weight on outrigger pads over a larger surface area.



Use solid blocking under all pads/floats.

OSHA®
1926.1402(b)

There are many types of ground bearing outrigger support available.

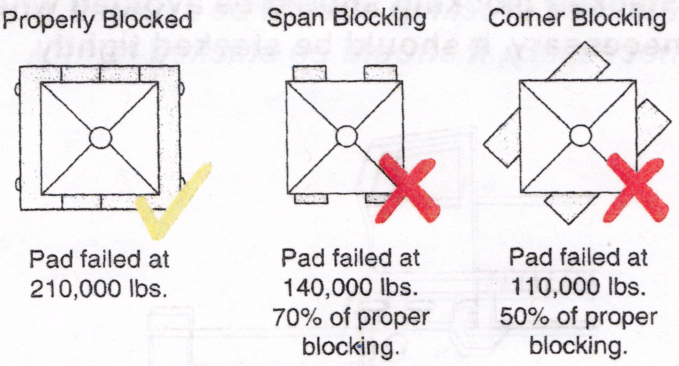


For a large telescopic boom AT crane: crushed limestone, 8"timber mat, steel plate, plywood

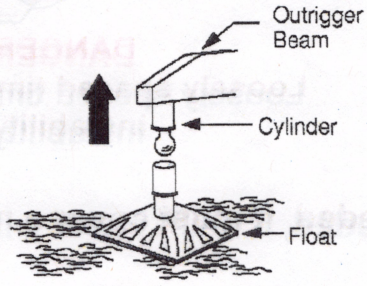
High-density plastic pads for smaller loads

What are the characteristics of proper outrigger blocking?

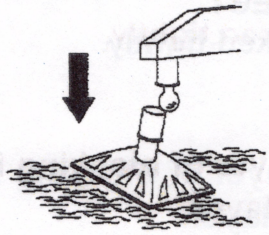
- » Rigid.
- » Tightly spaced.
- » Level.
- » Square.



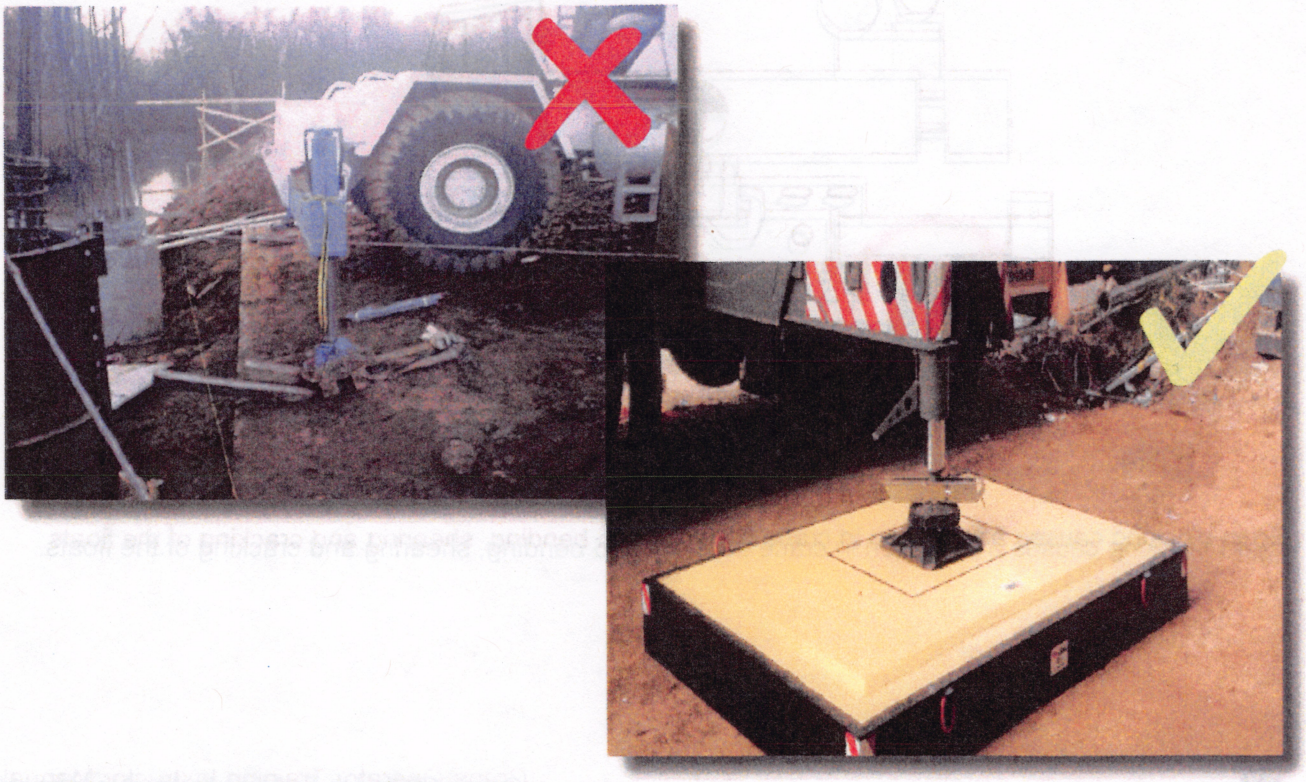
Always ensure pad/float is properly pinned to the outrigger cylinder.



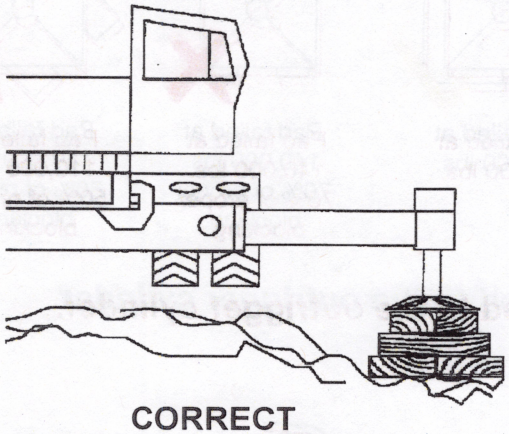
DANGER
If the pad/float is not pinned to the outrigger cylinder, it will separate from the cylinder when the crane's frame twists and the beam lifts under the load.



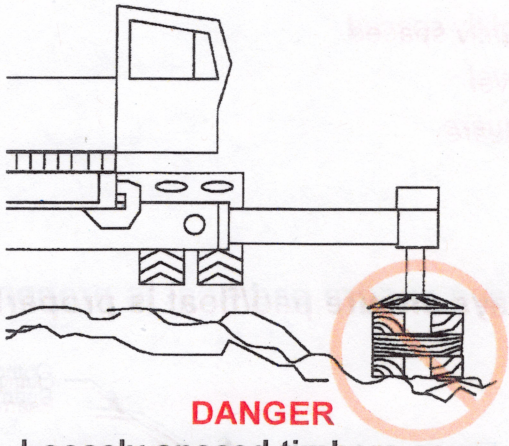
DANGER
If the crane swings and puts the load on the outrigger, the cylinder will return, but may not re-engage with the pad/float collar. It can miss completely and leave the outrigger without any support.



Stacked blocking should be avoided whenever possible, but when necessary, it should be stacked tightly.



CORRECT
Timbers stacked tightly.

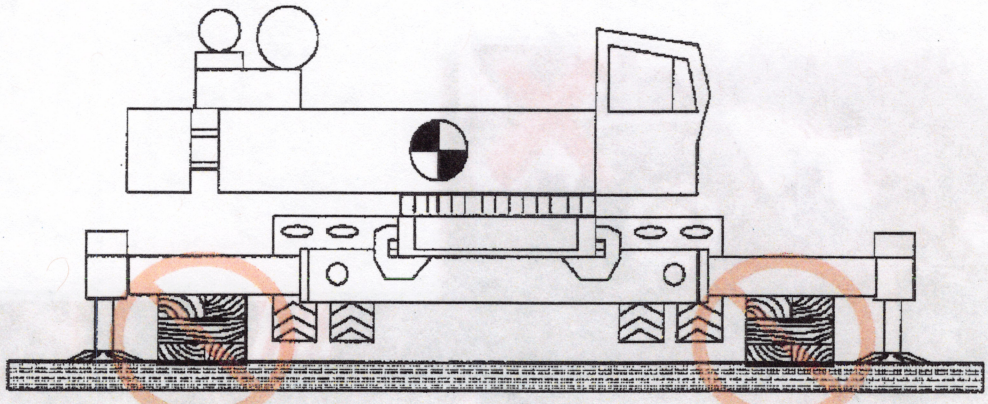


DANGER
Loosely spaced timbers cause instability.

If more than one layer of blocking is needed, it must cover a much larger area than a single layer.

Pyramid style blocking should be used if more than one layer of blocking is needed.

Blocking shall not be used under the outrigger beams or carrier.



WRONG! Never block under the outrigger beams inside of the outrigger pads.

Span blocking causes a reduction in crane capacity and bending, shearing and cracking of the floats.

Leveling

The one setup step most critical to safety is leveling.

The one setup step most critical to safety is leveling. To safely make a lift with a crane the crane must be level. The following is a quote from one crane manufacturer's operator's safety handbook. "The importance of properly leveling a crane cannot be overstressed. A crane only slightly out-of-level can quickly encounter a tipping condition."

A lift should not be attempted if a crane is not level.

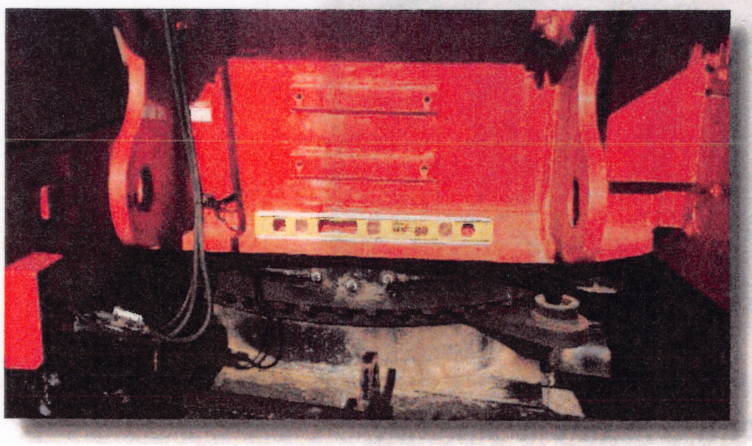
This is especially true for a near-capacity lift! Crane levelness should be checked frequently - especially when making a series of lifts. Standard operations can cause shifts and vibrations that can unlevel the crane.

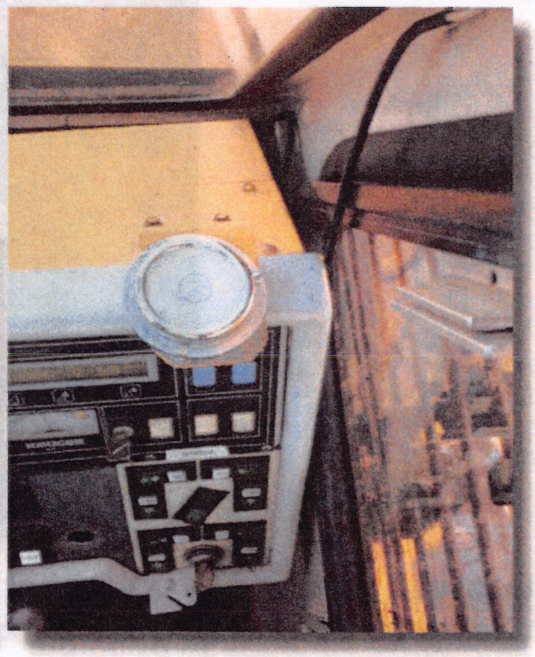
One percent off-level will cause side loading of the boom.

For a load rating to be accurate, a crane must be level within 1% of level grade! A crane off level by 3 degrees can increase chord stresses by as much as 50%. Cranes can not be leveled by using only the eye.

Use target level in the crane cab for initial leveling.

Target levels should only be used for initial setup leveling.





A level should be placed on the upper works to ensure a more accurate level reading.

Check level in several places.

Check level in one direction, rotate boom 90 degrees, then recheck.

New cranes are often equipped with a leveling device.

The crane is level when hoist rope is reeved into the center sheave and the hoist rope aligns with the center line of the boom.

Because crawler and on-rubber cranes can not be leveled, the ground should be as level as possible before crane is blocked.

Crane Safety Features

Safety features vary depending upon the manufacturer and crane model.

Safety features also vary in design and application.

What are some common safety features?

» Drum rotation indicators.

» Outriggers marked to indicate full extension.

» Spirit level at outrigger control.

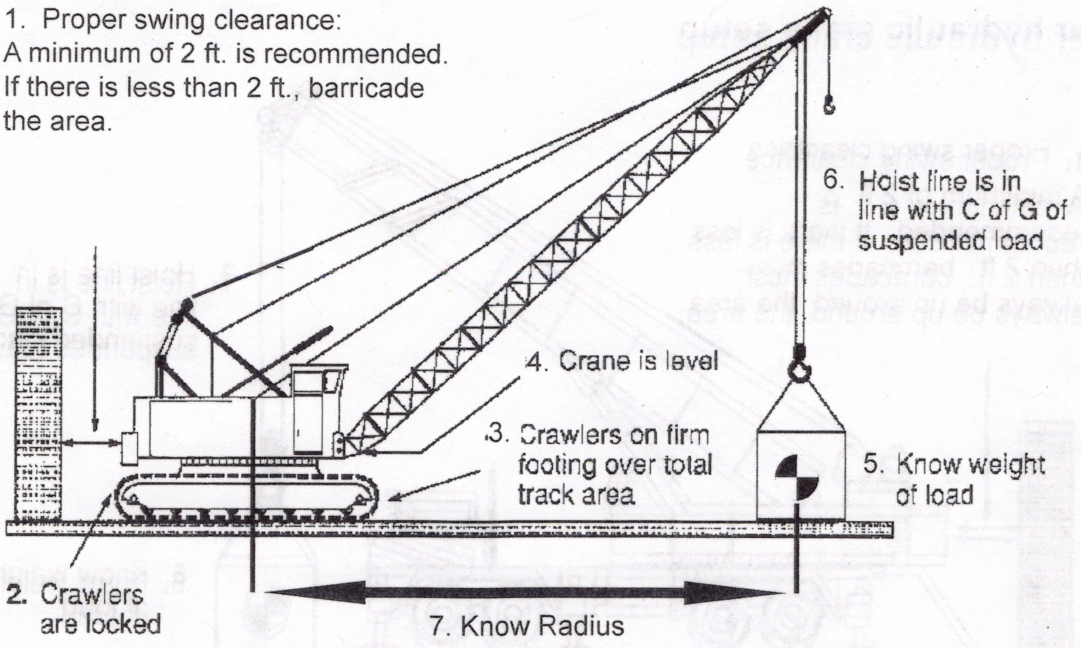
» Machined surface on revolving deck to check machine level.

» Boom angle indicators.

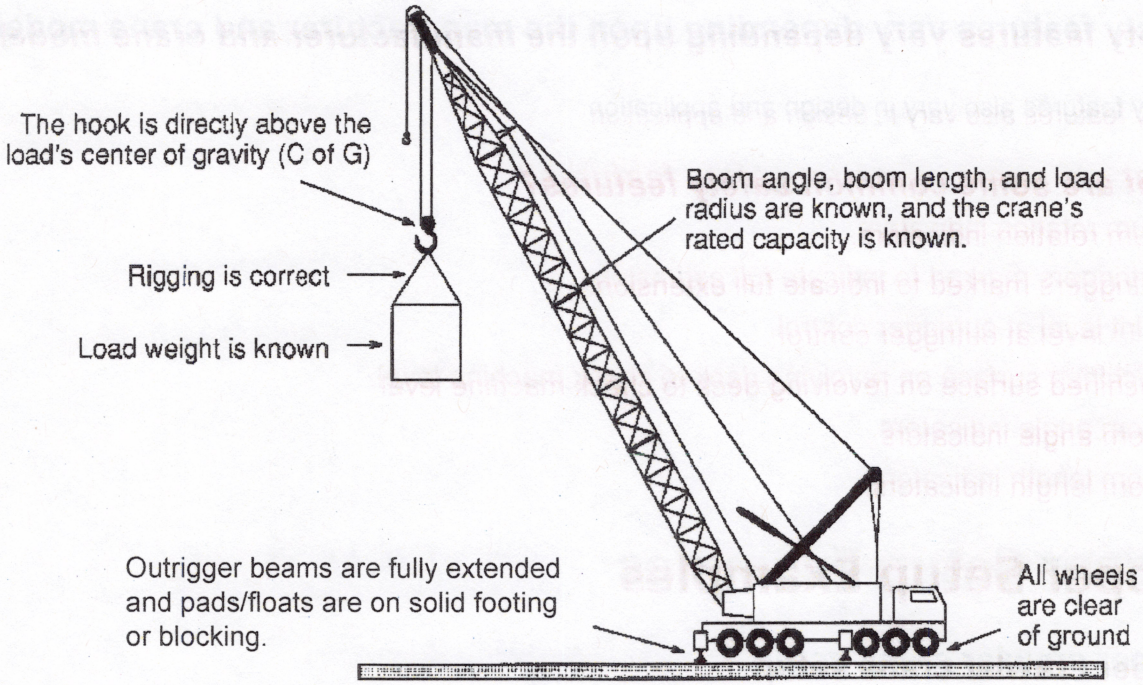
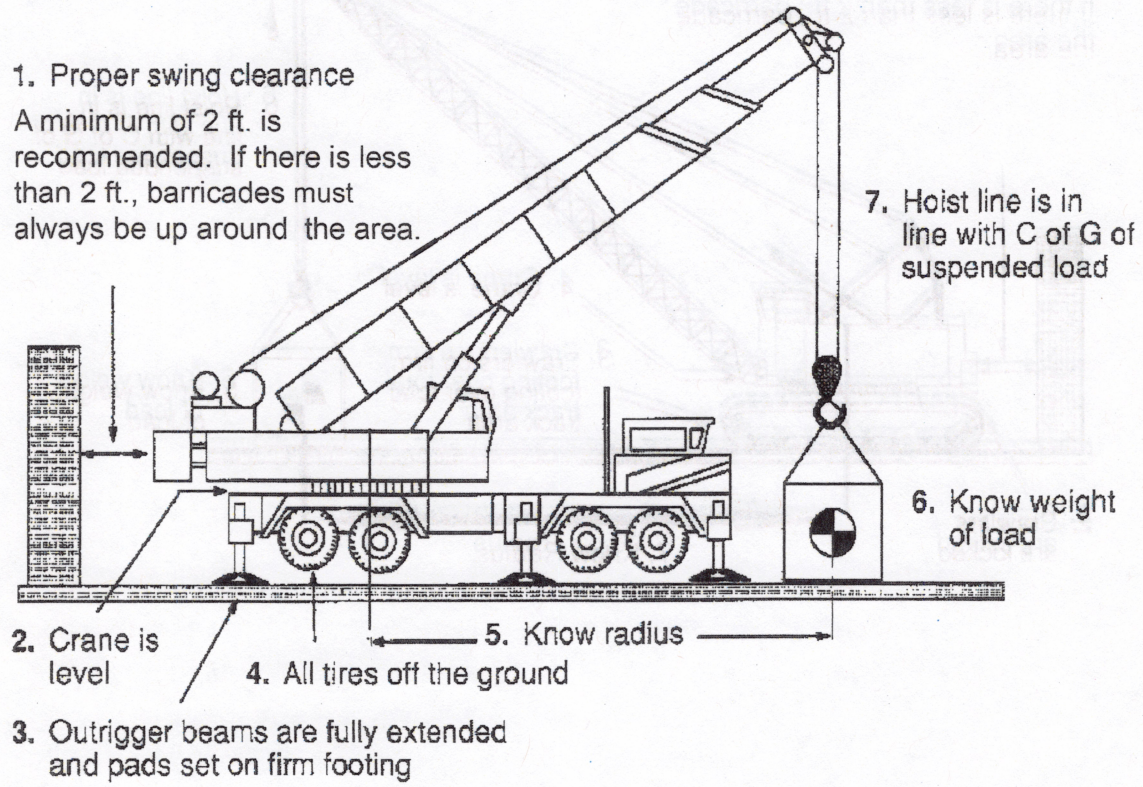
» Boom length indicators.

Proper Setup Examples

Proper crawler crane setup



Proper truck crane setup



Proper hydraulic crane setup